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Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

A

UTILITY
PATENT APPLICATION
TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.
518/K16-106

Total Pages

First Named Inventor or Application Identifier

Michael HUNG

Express Mail Label No.

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

Assistant Commissioner for Patents
ADDRESS TO: Box Patent Application
Washington, D.C. 20231

1. <input checked="" type="checkbox"/> Fee Transmittal Form (Submit an original, and a duplicate for fee processing)	6. <input type="checkbox"/> Microfiche Computer Program (Appendix)
2. <input checked="" type="checkbox"/> Specification [Total Pages 9] (preferred arrangement set forth below)	7. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary) a. <input type="checkbox"/> Computer Readable Copy b. <input type="checkbox"/> Paper Copy (identical to computer copy) c. <input type="checkbox"/> Statement verifying identity of above copies
ACCOMPANYING APPLICATION PARTS	
3. <input checked="" type="checkbox"/> Drawing(s) (35 USC 113) [Total sheets - 6]	8. <input type="checkbox"/> Assignment Papers (cover sheet & document(s))
4. Oath or Declaration [Total Pages - 2]	9. <input type="checkbox"/> 37 CFR 3.73(b) Statement <input type="checkbox"/> Power of Attorney (when there is an assignee)
a. <input checked="" type="checkbox"/> Newly executed (original or copy) b. <input type="checkbox"/> Copy from a prior application (37 CFR 1.63(d)) (for continuation/divisional with Box 17 completed) <i>[Note Box 5 below]</i>	10. <input type="checkbox"/> English Translation Document (if applicable)
i. <input type="checkbox"/> <u>DELETION OF INVENTOR(S)</u> Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).	11. <input type="checkbox"/> Information Disclosure Statement (IDS)/PTO-1449 <input type="checkbox"/> Copies of IDS Citations
5. <input type="checkbox"/> Incorporation By Reference (usable if Box 4b is checked) The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.	12. <input type="checkbox"/> Preliminary Amendment
17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information: <input type="checkbox"/> Continuation <input type="checkbox"/> Divisional <input type="checkbox"/> Continuation-in-part (CIP) of prior application No.	13. <input checked="" type="checkbox"/> Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
18. CORRESPONDENCE ADDRESS	
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ACCOUNT NO. 23 0975.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :
Michael HUNG :
Serial No. NEW : ATTN: APPLICATION BRANCH
Filed February 13, 1998 : Attorney Docket No.
SHUTTLE VALVE OF A : 518/K16-106
RECIPROCATING PNEUMATIC
MOTOR FOR HYDRAULICS

PATENT OFFICE FEE TRANSMITTAL FORM

Assistant Commissioner for Patents,
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Sir:

Attached hereto is a check in the amount of \$395.00 to cover Patent Office fees relating to filing the following attached papers:

New application \$395.00

A duplicate copy of this paper is being submitted for use in the Accounting Division, Office of Finance.

The Commissioner is authorized to charge any deficiency or to credit any overpayment associated with this communication to Deposit Account No. 23-0975, with the EXCEPTION of deficiencies in fees for multiple dependent claims in new applications.

Respectfully submitted,

Michael HUNG

By:


Nils E. Pedersen
Registration No. 33,145
Attorney for Applicant

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February 13, 1998

[Check No. 27311]

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FILE FOR THIS PAPER TO DEPOSIT
ACCOUNT NO. 23 0975.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :
Michael HUNG :
Serial No. NEW : **Attn: APPLICATION BRANCH**
Filed February 13, 1998 : Docket No. 518/K16-106
SHUTTLE VALVE OF A
RECIPROCATING PNEUMATIC
MOTOR FOR HYDRAULICS :

CHANGE OF ADDRESS

Assistant Commissioner for Patents,
Washington, D.C.

Sir:

Effective MARCH 1, 1998, please note the following

change of address for the undersigned attorney of record:

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2033 "K" Street N.W.
Suite 800
Washington, D.C. 20006**

Respectfully submitted,

Michael HUNG

By:



Nils E. Pedersen
Registration No. 33,145
Attorney for Applicant

Washington, D.C.
February 13, 1998
/pth

SHUTTLE VALVE OF A RECIPROCATING PNEUMATIC MOTOR FOR HYDRAULICS

BACKGROUND OF THE INVENTION

(a) Field of the Invention:

The present invention relates to a shuttle valve for a reciprocating pneumatic motor for hydraulics, and more particularly to such a shuttle valve which has a press rod supported on a compression spring in it that causes the pneumatic piston to change its stroke subject to the condition of the load.

(b) Description of the Prior Art:

US Pat. No. 5,341,723 which is issued to the present inventor discloses a reciprocating pneumatic motor for hydraulics which has a pair of guide grooves on the inner wall of a cylinder provided, together with a pneumatic piston and a shuttle valve to function pneumatically. The piston has a seal ring which passes the guide grooves to allow air to flow into the shuttle compression chamber, pushing the shuttle valve and opening up a channel for the venting of air. The piston is integrated with a ring plate using plastic ultrasound technology which simplifies the structure of the pneumatic motor. This structure of reciprocating pneumatic motor is functional. However, because the stroke of the pneumatic piston maintains unchanged when bearing no load, the working efficiency

of the reciprocating pneumatic motor is slightly low.

SUMMARY OF THE INVENTION

The present invention improves the structure of the shuttle valve indicated in US Pat. No. 5,341,723. The shuttle valve has a press rod and a compression spring mounted in a longitudinal center through hole in the valve body thereof. The press rod is forced out of the front end of the body of the shuttle valve by the compression spring to press against the cylinder cover of the reciprocating pneumatic motor, enabling the shuttle valve to shut off automatically at an early stage so as to extend the piston stroke when the pneumatic piston bears the load, or to shorten the piston stroke when the pneumatic piston bears no load.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an exploded view of a reciprocating pneumatic motor constructed according to the present invention.

Figure 2 is a cross-sectional view of the motor in a stage before compression according to the present invention.

Figure 3 is a cross-sectional view of the motor showing the external air path as it enters the cylinder to push the pneumatic piston according to the present invention.

Figure 4 is a cross-sectional view of the motor showing the shuttle valve in an open position according to the present invention.

Figure 5 is a cross-sectional view of the motor showing the shuttle valve in a closed position at the air of the first cycle of the operation according to the present invention.

Figure 6 is a perspective view of a hydraulic jack with the reciprocating pneumatic motor according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Figures 1 and 2, a reciprocating pneumatic motor is shown comprised of a cylinder **1** having a pneumatic piston **4** and a piston rod **5** therein, a cylinder cover **2** and a bottom cover **3**. The cylinder **1** has the cylinder cover **2** on its top and the bottom cover **3** on its bottom, said covers are preferably joined one at each end of cylinder, using hex bolts **21**. At a selected location in the cylinder body is a pair of corresponding guide grooves **11** which protrude from the exterior wall. The guide grooves **11** are punched directly during fabrication and do not require additional machining or grinding. The cylinder cover **2** has bolt holes **22** in the four corners thereof for the hex bolts **21** to extend through and an air inlet hole **23** is opened at a selected location on the cylinder cover **2**. The bottom cover **3** also has bolt holes **31** in the four corners thereof for the hex bolts **21** to be screwed in. The center of the bottom cover **3** has a central hole **32** for a piston pump **33** to extend through. The surface and the edge of the bottom cover **3** have a plurality of

L-shaped holes 34. The inside diameter of an upper portion of the piston pump 33 has a liner 331 and an O-ring 332 which extend through the bottom cover 3 and lock onto a piston pump cover 35. The lower portion of the piston pump 33 has an oil seal 333, a washer 334 and a hex nut 335. The pneumatic piston 4 is a circular body having a first seal ring 41 on its top and a second seal ring 41' on its bottom. The circular body of the pneumatic piston 4 has an indented surface on which a ring plate 42 is joined with an appropriate gap 422, as shown in Figure 2. The central part of the indented surface of the circular piston body has a central slotted hole (not shown) from which a radial air inlet hole 44 is connected. The indented surface has an air vent hole 45 which is located closely to the central slotted hole (not shown). A shuttle compression chamber 47 is formed at the indented surface of the circular body of the pneumatic piston 4. A shuttle valve 6 is mounted between the pneumatic piston 4 and the ring plate 42, and moved to control the passage between the shuttle compression chamber 47 and the radial air inlet hole 44. The piston rod 5 has one end extending through the piston pump cover 35 into the piston pump 33 and the other end is locked onto a spring base 51 from which a coiled spring 52 is attached. The spring base 51 is snug to the bottom of the pneumatic piston 4. The stretching of the coiled spring 52 enables the

reciprocating movement of the piston rod 5.

The body of the shuttle valve 6 has a longitudinal center through hole 61 through its longitudinal central axis, and an inside annular flange 62 at the front end of the longitudinal center through hole 61. The rear end of the longitudinal center through hole 61 is covered with an end cap 65. A compression spring 64 is mounted inside the longitudinal center through hole 61 and supported on the end cap 65. A press rod 63 is supported on the compression spring 64 inside the longitudinal center through hole 61, having a front end extending out of the inside annular flange 62 and an outward flange 631 raised around a rear end thereof and supported on the compression spring 64. The compression spring 64 imparts an outward pressure to the press rod 63, causing it to extend out of the front end of the body of the shuttle valve 6. The inside annular flange 62 of the body of the shuttle valve 6 stops the outward flange 631 of the press rod 63 from passing through. Further, a gasket ring 66 and an oil seal ring 67 are mounted around the outside wall of the body of the shuttle valve 6 near its two opposite ends.

Referring to Figures 2 and 3, compressed air entering from the air inlet hole 23 of the cylinder cover 2 pushes the pneumatic piston 4 forwards. When the first seal ring 41 passes the guided grooves 11, a gap is formed. This gap allows the air to pass

through the radial air inlet hole 44 and into the shuttle compression chamber 47, as shown in the direction of the arrow in Figure 3. Since the bottom surface area of the shuttle valve 46 is larger than its top surface area, therefore, under the same force condition, the pressure exerted on the bottom surface area is higher than of the top surface area. This higher pressure can push the shuttle valve 6 forward and open up the air vented hole 45. At the same time, an air gap is formed (as shown in Figure 4) between the shuttle valve 6 and the ring plate 42 which allows air to pass through to the air vented hole 45 and rapidly vent through the L-shaped holes 34 to the outside. The venting lowers the pressure to a point that the tension of the coiled spring 52 pushes the piston rod 5 backward to its original state. The remaining air in the shuttle compression chamber 47 passes through the gap between the second seal ring 41' and the guided grooves 11 and is vented out through the L-shaped holes 34, as shown in Figure 5. When the air in the shuttle compression chamber 47 is completely vented, the shuttle valve 46 shuts off automatically and returns to its original state, as shown in Figure 2. The compressed air going in and the venting are happening instantaneously, therefore the piston rod 5 begins reciprocating.

As indicated above, the shuttle valve 6 has the press rod 63

and the compression spring 64 in it. The press rod 63 is used to press against the cylinder cover 2, enabling the shuttle valve 6 to shut off automatically at an early stage, so as to shorten the stroke of the pneumatic piston 4. When the pneumatic piston 4 bears the load, the front air chamber, referenced by A, has a relatively higher pressure, which passes the guide grooves 11 to push open the shuttle valve 6, and is then accumulated in the shuttle compression chamber 47 after the shuttle valve 6 has been opened. When the pneumatic piston 4 moves to the guide grooves 11 (see Figure 3), the shuttle valve 6 starts to shut off, and air must be carried away from the shuttle compression chamber 47. Because the L-shaped holes 34 are throttled at this stage, high pressure air which comes from the front air chamber A is not completely exhausted, much pressure is needed to close the shuttle valve 6, thereby causing the compression stroke of the compression spring 64 as well as the stroke of the pneumatic piston 4 to be relatively increased.

As indicated above, the stroke of the pneumatic piston 4 is relatively increased and its speed is relatively slowed down when bearing the load. On the contrary, when the pneumatic piston 4 bears no load, its stroke is relatively shortened, and its speed is relatively accelerated.

What the invention claimed is:

1. A shuttle valve mounted between a pneumatic piston and a ring plate in a reciprocating pneumatic motor and moved to control the passage between a shuttle compression chamber and a radial air inlet hole in the pneumatic piston, the shuttle valve comprising a valve body having a longitudinal center through hole and an inside annular flange at one end of said longitudinal center through hole, an end cap fixedly fastened to one end of said longitudinal center through hole on said valve body remote from said inside annular flange, a compression spring mounted inside said longitudinal center through hole and supported on said end cap, a press rod supported on said compression spring inside said longitudinal center through hole, said press rod having a front end extending out of said valve body and an outward flange raised around a rear end thereof and supported on said compression spring, the outward flange of said press rod being stopped by said inside annular flange from passing out of said valve body, a gasket ring and an oil seal ring respectively mounted around said valve body on the outside near two opposite ends thereof.

ABSTRACT OF THE DISCLOSURE

A shuttle valve mounted between a pneumatic piston and a ring plate in a reciprocating pneumatic motor and moved to control the passage between a shuttle compression chamber and a radial air inlet hole in the pneumatic piston, the shuttle valve having a press rod supported on a compression spring and forced out of the front end of the body of the shuttle valve for pressing against the cylinder cover of the reciprocating pneumatic motor, enabling the shuttle valve to shut off automatically at an early stage so as to extend the piston stroke when the pneumatic piston bears the load, or to shorten the piston stroke when the pneumatic piston bears no load.

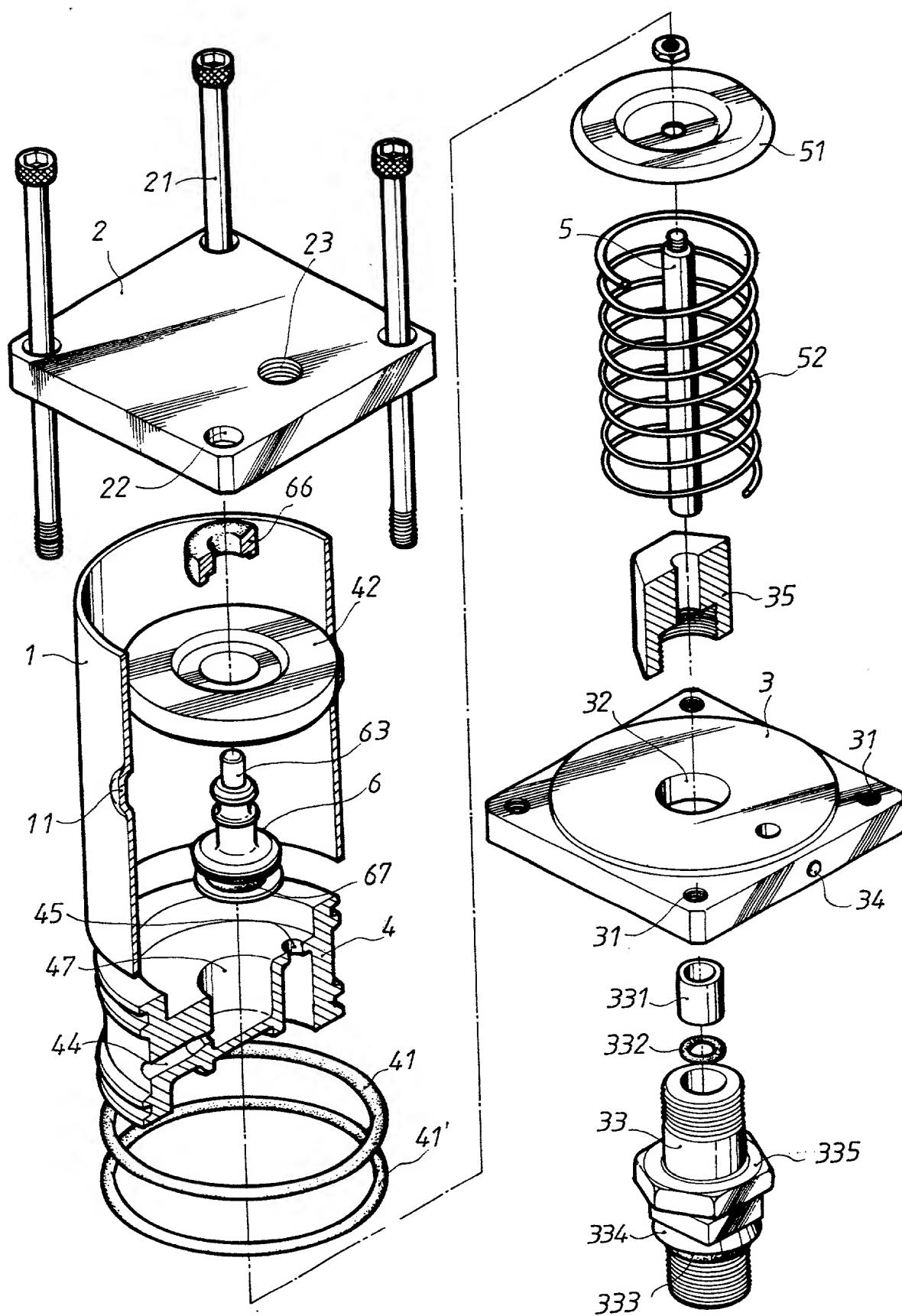


FIG. 1

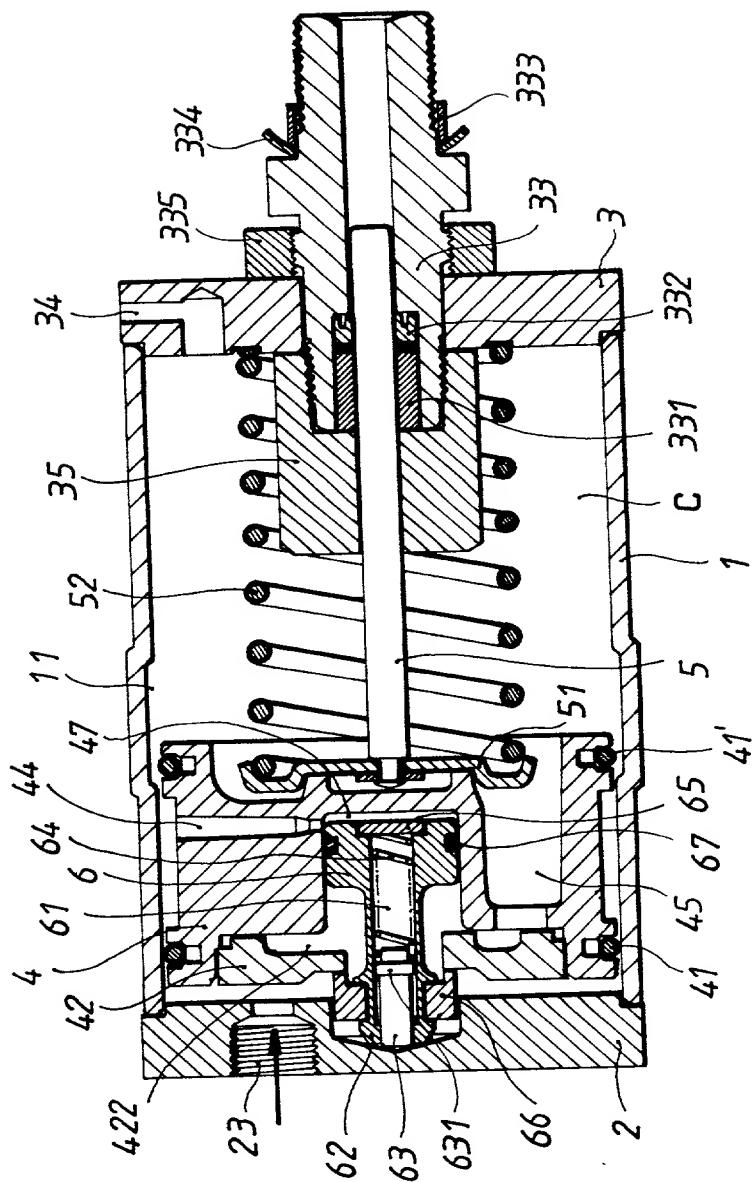


FIG. 2

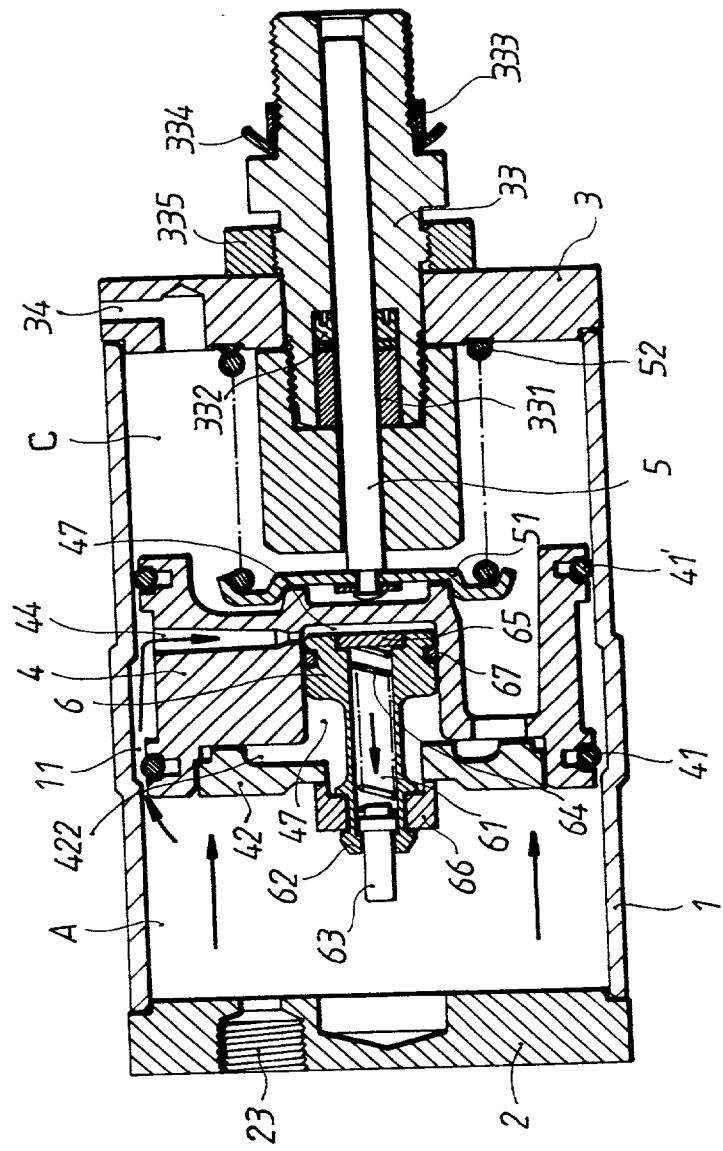


FIG. 3

FIG. 4

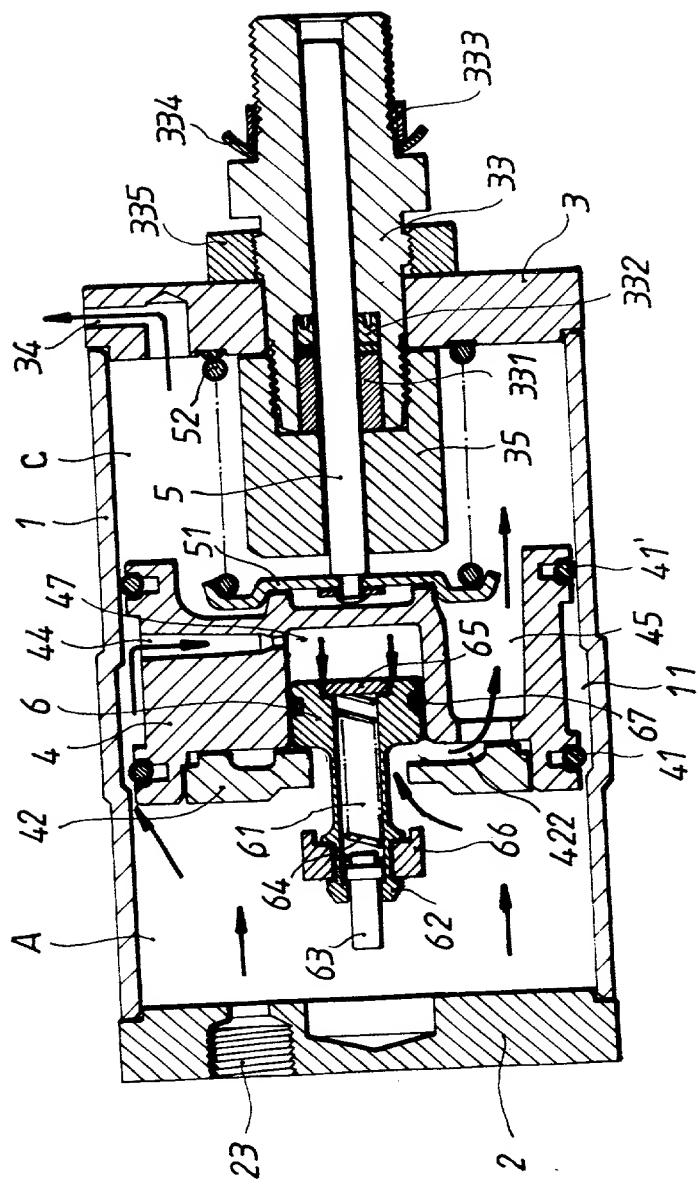
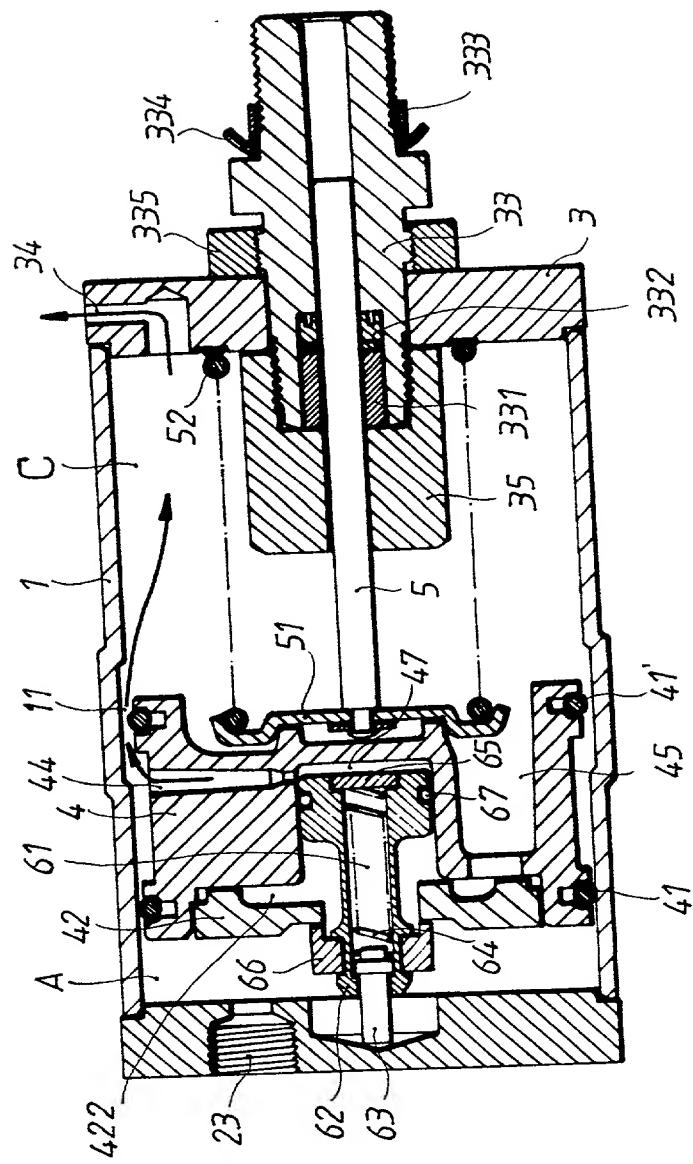


FIG. 5



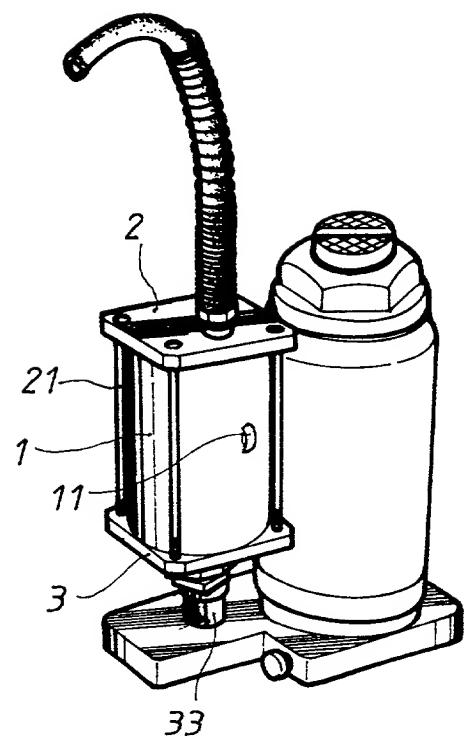


FIG. 6

DECLARATION AND POWER OF ATTORNEY FOR U.S. PATENT APPLICATIONS

(X) Original () Supplemental () Substitute () PCT () DESIGN

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that I verily believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Title: SHUTTLE VALVE OF A RECIPROCATING PNEUMATIC MOTOR FOR HYDRAULICS

which is described and claimed in:

(X) the attached specification, or
 () the specification in the application Serial No. _____ filed _____;
 and with amendments through _____ (if applicable),
 () the specification in International Application No. PCT/_____, filed _____, and as amended on _____ (if applicable).

I hereby state that I have reviewed and understand the content of the above-identified specification, including the claims, as amended by any amendment(s) referred to above.

I acknowledge my duty to disclose information of which I am aware which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 (and §172 if this application is for a Design) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

COUNTRY	APPLICATION NO.	DATE OF FILING	PRIORITY CLAIMED
_____	_____	_____	() YES () NO
_____	_____	_____	() YES () NO
_____	_____	_____	() YES () NO
_____	_____	_____	() YES () NO
_____	_____	_____	() YES () NO
_____	_____	_____	() YES () NO

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

SERIAL NO.	U.S. FILING DATE	STATUS
_____	_____	() Patented () Pending () Abandoned
_____	_____	() Patented () Pending () Abandoned
_____	_____	() Patented () Pending () Abandoned

And I hereby appoint V. M. Creedon, Reg. No. 17111, John T. Miller, Reg. No. 21120, John T. Fedigan, Reg. No. 24347, Michael R. Davis, Reg. No. 25134, Matthew M. Jacob, Reg. No. 25154, Jeffrey Nolton, Reg. No. 25408, and Henry M. Zykorie, Reg. No. 27477, who together constitute the firm of WENDEROTH, LIND & PONACK, jointly and severally, attorneys to prosecute this application and to transact all business in the U.S. Patent and Trademark Office connected therewith.

I hereby authorize the U.S. attorneys named herein to accept and follow instructions from Kingword International PT & TM Office as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. attorneys and myself. In the event of a change in the persons from whom instructions may be taken, the U.S. attorneys named herein will be so notified by me.

Send Correspondence to:

Direct Telephone Calls to:

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WENDEROTH, LIND & PONACK
 Area Code (202) 371-8850

Effective March 7, 1988

FULL NAME OF 1ST INVENTOR	FAMILY NAME HUNG	FIRST GIVEN NAME Michael	SECOND GIVEN NAME
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RESIDENCE & CITIZENSHIP	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP
POST OFFICE ADDRESS	ADDRESS	CITY	STATE OR COUNTRY ZIP CODE
FULL NAME OF 3RD INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
RESIDENCE & CITIZENSHIP	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP
POST OFFICE ADDRESS	ADDRESS	CITY	STATE OR COUNTRY ZIP CODE
FULL NAME OF 4TH INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
RESIDENCE & CITIZENSHIP	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP
POST OFFICE ADDRESS	ADDRESS	CITY	STATE OR COUNTRY ZIP CODE
FULL NAME OF 5TH INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
RESIDENCE & CITIZENSHIP	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP
POST OFFICE ADDRESS	ADDRESS	CITY	STATE OR COUNTRY ZIP CODE
FULL NAME OF 6TH INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
RESIDENCE & CITIZENSHIP	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP
POST OFFICE ADDRESS	ADDRESS	CITY	STATE OR COUNTRY ZIP CODE

R.O.C.

I further declare that all statements made herein of my own knowledge are true, and that all statements on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

1st Inventor Michael Hung Date February 2, 1998
Michael HUNG
2nd Inventor _____ Date _____
3rd Inventor _____ Date _____
4th Inventor _____ Date _____
5th Inventor _____ Date _____
6th Inventor _____ Date _____

The above application may be more particularly identified as follows:

U. S. Application Serial No., Filing Date
Applicant Reference Number, Atty Docket No.
Title of Invention

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ACCOUNT NO. 23 0975.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :
Michael HUNG :
Serial No. NEW : **ATTN: APPLICATION BRANCH**
Filed February 13, 1998 : **Attorney Docket No.**
SHUTTLE VALVE OF A : **518/K16-106**
RECIPROCATING PNEUMATIC :
MOTOR FOR HYDRAULICS :

**COVER LETTER RE: DECLARATION SUPPORTING CLAIM
FOR SMALL ENTITY STATUS**

Assistant Commissioner for Patents,
Washington, D.C.

Sir:

Submitted herewith is a Declaration Supporting Claim for Small Entity Status in the subject application.

Respectfully submitted,

Michael HUNG

By:

Nils E. Pedersen
Registration No. 33,145
Attorney for Applicant

NEP/pth
Washington, D.C.
Telephone (202) 371-8850

February 13, 1998

DECLARATION SUPPORTING CLAIM FOR SMALL ENTITY STATUS

The undersigned hereby declare(s) that this statement is made to support a claim by the below identified entity for purposes of paying reduced fees under Secs. 41(a) and (b) of Title 35, United States Code, with regard to an invention entitled SHUTTLE VALVE OF A RECIPROCATING PNEUMATIC MOTOR FOR HYDRAULICS

invented by Michael HUNG and described in

the specification filed herewith.

application Serial No. _____, filed _____.

Patent No. _____, issued _____.

a. I am/we are the inventor(s) of the above-identified invention.
 b. I/we would qualify as (an) independent inventor(s) as defined in 37 CFR 1.9(c) if I/we had made the above-identified invention, and rights under contract law with regard to the above-identified invention have been conveyed to and remain with me/us.

c. I am [] the owner
rights under contract law with regard to the above-identified invention have been conveyed to and remain with the below-identified small business concern; and this concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under sections 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons, said number being determined and said affiliates being defined in 13 CFR 121.3-18.

No rights in the invention have been assigned, granted, conveyed or licensed or further assigned, granted, conveyed or licensed, and there is no obligation under contract or law to assign, grant, convey or license, or further assign, grant, convey or license such rights to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which any rights in the invention have been assigned, granted, conveyed, or licensed or further assigned, granted, conveyed, or licensed or further assign, grant, convey or license, or as to where there is an obligation under contract or law to assign, grant, convey, or license such rights is listed below:

no such person, concern, or organization
 persons, concerns or organizations listed below*

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

FULL NAME _____

ADDRESS _____

INDIVIDUAL SMALL BUSINESS CONCERN NONPROFIT ORGANIZATION

FULL NAME _____

ADDRESS _____

INDIVIDUAL SMALL BUSINESS CONCERN NONPROFIT ORGANIZATION

I/we acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I/we hereby declare that all statements made herein of my/our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this declaration is directed.

Michael HUNG



February 2, 1998

DATE

NAME

SIGNATURE

DATE

NAME

SIGNATURE

DATE

NAME OF SMALL BUSINESS CONCERN ADDRESS

NAME

SIGNATURE

DATE

TITLE

Rev.10/89